

Appl. No : 09/971,455
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76. (ORIGINAL) The thin film structure of Claim 72, wherein the nucleation layer is Mn.

77. (ORIGINAL) The thin film structure of Claim 72, wherein the nucleation layer has a thickness of less than about 50 Å.

REMARKS

Definiteness under 35 U.S.C. § 112

Claim 71 was rejected under 35 U.S.C. § 112, second paragraph for being indefinite for reciting a claim limitation with insufficient antecedent basis. Applicant submits that Claim 71, as amended, provides proper antecedent basis.

Claims 16 and 17 Are Cancelled

Claims 16, 17 were rejected under 35 U.S.C. § 102(b) as being anticipated by Fujii et al (JP406333772A also note parallel US and European patents listed on the enclosed form PTO-1449). As indicated above, Claims 16 and 17 have been cancelled without prejudice. Applicant reserves the right to pursue the cancelled claims in subsequent continuing applications. Applicant respectfully submits that the rejections of Claims 16 and 17 are moot in view of the cancellation of these claims.

Claims 29-36 Are In Condition For Allowance

Claims 29-33 were rejected under 35 U.S.C. § 102(b) as being anticipated by Fujii et al (JP406333772A also note parallel US and European patents listed on the enclosed form PTO-1449). The Examiner asserts that Fujii teaches the apparatus substantially as claimed. Claims 34-36 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Fujii et al. in view of Summerfelt et al (US 5,781,404). The Examiner further asserted that it would have been obvious to incorporate the ST layer between a BST layer and a Pt layer as taught by Summerfelt et al. into Fujii et al.'s device. The Examiner further asserted that the ST layer of Summerfelt comprises titanium.

Claims 29, 31 and 32 were also rejected under 35 U.S.C. § 102(e) as being anticipated by Abe et al. (US 5,889,299). Applicant submits that Abe does not teach all of the limitations of Claims 29, 31 and 32, as amended, for at least the same reasons as discussed above. In particular, Abe et al. does not teach or suggest a nucleation layer formed anywhere

Appl. No : 09/971,155
Filed : October 4, 2001

in the capacitor structure. The structure indicated by the Examiner as a "nucleation layer" is described by Abe as being a MgO substrate (see Column 20, lines 38 and 39).

Applicant traverses the rejections and respectfully disagrees with the Examiner's characterization of the cited references. With regard to Claim 29, Applicant respectfully submits that the prior art of record does not teach or suggest the combination of limitations recited in Claim 29, as amended.

Claim 29, as amended, recites:

29. *A thin film structure, comprising:*
a substrate;
a first electrode formed over said substrate;
a nucleation layer for improving the uniformity of a crystal orientation of a BST film formed thereon, wherein said nucleation layer is a donor or acceptor dopant layer formed over said first electrode; and
a BST film over the nucleation layer having a substantially uniform crystal orientation.

Applicant respectfully submits that the prior art of record does not teach or suggest "a nucleation layer for improving the uniformity of a crystal orientation of a BST film formed thereon, wherein said nucleation layer is a donor or acceptor dopant layer formed over said first electrode" as recited by Claim 29, as amended.

As described in the above-identified application at page 8, lines 17-20, the nucleation layer can act as either a donor or acceptor dopant to correct for defects in the BST film. Thus, for at least these reasons, Applicant submits that Claim 29 is in condition for allowance.

Additionally, Applicant submits that dependent Claims 30-36 recite further unique combinations of limitations in addition to the unique combination of limitations recited in Claim 29. Thus, Applicant submits that Claims 29-36 are in condition for allowance and respectfully requests that the rejections of these claims be withdrawn.

Claims 54-66 Are In Condition For Allowance

Claims 54-66 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Fujii et al. in view of Summerfelt et al (US 5,781,404). The Examiner asserts that Fujii et al. does

Appl. No : 09/971,155
Filed : October 4, 2001

not teach a second nucleation layer formed between the BST film and the orientation layer. However, the Examiner asserts that it would have been obvious to incorporate the ST layer between a BST layer and a Pt layer as taught by Summerfelt et al. into Fujii et al.'s device (FIG. 4) in order to reduce the leakage current. Applicant respectfully traverses the rejection and submits that it would not have been obvious to a person having ordinary skill in the art to make the suggested combination.

The Examiner asserted that it would have been obvious to a person having ordinary skill in the art to provide the suggested combination in order to reduce the leakage current. While this appears to be an accurate characterization of the recited advantages of Summerfelt's structure, Applicant respectfully submits that this would not have led a person having ordinary skill in the art to *combine* the teachings of Summerfelt with those of Fujii et al.

Fujii et al. (US Patent No. 5,406,445) teaches thin film capacitors having a spinel oxide thin layer or a NaCl oxide thin layer oriented to a (100) face, and a perovskite dielectric thin layer oriented to the (100) face formed between first and second metal electrodes. Fujii teaches embodiments in which a spinel oxide or a NaCl oxide layer is formed above the bottom electrode, and embodiments in which a spinel oxide or a NaCl oxide layer is formed below the bottom electrode in order to improve a crystal orientation of the perovskite dielectric thin layer. As discussed in Fujii at column 4, lines 9-27, the invention described therein is intended to improve the electric characteristics of a thin film capacitor by improving the crystallinity of the dielectric layer.

Summerfelt et al. teaches a method of reducing the leakage current of a capacitor by providing additional layers of dielectric material between first and second electrodes. Summerfelt teaches placing dielectric buffer layers of first and third layers of leakage-current-density materials (such as Strontium Titanate) having moderate dielectric constants above and below a BST layer (which is said to have a high dielectric constant). Summerfelt teaches that the first and third leakage-current-density materials (e.g. ST) have substantially lower leakage-current densities than the second leakage-current-density material (e.g. BST).

Applicant respectfully submits that nowhere does Summerfelt address the desired crystal orientation of the BST film, nor is there any suggestion anywhere in the prior art of

Appl. No : 09/971,155
Filed : October 4, 2001

record that a Strontium Titanate layer would act as a nucleation layer to improve the uniformity of crystal orientation of a BST film. Applicant submits that a person having ordinary skill in the art seeking to improve the uniformity of the crystal orientation of a BST film would not have combined the teachings of Summerfelt et al. with those of Fujii et al.

Moreover, assuming that the structure of Fujii et al. provides the advantages recited therein, there would be no reason to reduce the leakage current of the Fujii's structure as this would be achieved by the improvement of the crystal orientation of the BST film in the structure taught therein.

Furthermore, there is no teaching or suggestion in the prior art of record that providing the combination suggested by the Examiner could be reasonably expected to produce a desirable result. Applicant respectfully submits that without a reasonable expectation that such a combination would not negatively affect other aspects of the manufacture or functionality of the capacitor of Fujii, a person having ordinary skill in the art would not have found it obvious at the time the invention was made to make the combination suggested by the Examiner.

Applicant therefore respectfully submits that Claim 54, as amended, is in condition for allowance. Furthermore, Applicant submits that dependent Claims 55-66 recite further unique combinations of limitations in addition to the unique combination of limitations recited in Claim 54.

For example, with respect to Claims 65 and 66, The Examiner asserted that it would have been obvious to provide the percent of Ti in the BST as claimed, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering optimum or workable ranges involves only routine skill in the art.

Applicant respectfully disagrees with the characterization of these limitations as being simply "optimum" ranges. Applicant submits that a rejection based on "optimum or workable ranges" is inappropriate where the prior art does not teach or suggest the desirability of the result achieved. As discussed in MPEP § 2144.05, "[a] particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation." In re Antonie, 559 F.2d

Appl. No : 09/971,155
Filed : October 4, 2001

618, 195 U.S.P.Q. 6 (CCPA 1977). Thus, for a rejection to be made based on "optimum or workable ranges," the prior art must first identify the result which the variable achieves.

In one embodiment of the above-identified application, the problem of haze in BST films can be substantially eliminated by controlling the resulting atomic percent of Titanium in the BST film. As described at page 6, line 28 through page 7, line 1; and page 7, lines 22-23 of the specification of the present application, a concentration of Ti between about 50 and 53.5 atomic percent favors a more haze-free film.

Applicant submits that the prior art of record fails to teach or suggest the desirability of varying Ti content of the BST film in addressing the problem of haze. Accordingly, without disclosing this desired result, Fujii and Summerfelt cannot be used to reject the claims on the basis that the parameters affecting this result are merely "optimum or workable" ranges that would be known to one of skill in the art.

Thus, for at least the above reasons, Applicant submits that Claims 54-66 are in condition for allowance and respectfully requests that the rejections of these claims be withdrawn.

Claims 67-71 Are In Condition For Allowance

Claims 67-69 were rejected under 35 U.S.C. § 102(b) as being anticipated by Fujii et al. The Examiner asserts that Fujii teaches the apparatus substantially as claimed. Claims 70 and 71 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Fujii et al in view of Summerfelt et al. Applicant traverses the rejection, and respectfully submits that Fujii et al. does not teach or suggest all the limitations of the Claims as amended.

Applicant respectfully submits that the prior art of record does not teach or suggest the unique combination of limitations recited in Claim 67, as amended. Claim 67 has been amended as indicated above to include the limitation, "a BST film formed over the electrode material and the nucleation layer, the BST film comprising between about 50 and 53.5 atomic percent Ti."

As discussed above, with respect to Claims 65 and 66, Applicant submits that the prior art of record fails to teach or suggest the desirability of varying Ti content of the BST film in addressing the problem of haze. Accordingly, without disclosing this desired result, Fujii and Summerfelt cannot be used to reject the claims on the basis that the parameters

Appl. No : 09/971,155
Filed : October 4, 2001

affecting this result are merely "optimum or workable" ranges that would be known to one of skill in the art.

Therefore, Applicant respectfully submits that Claim 67, as amended, is in condition for allowance. Applicant further submits that Claims 68-71 are dependent on Claim 67 and thus include the unique combination of limitations recited in Claim 67 as well as additional combinations of limitations also not taught or suggested by the prior art of record. Thus, Applicant respectfully requests that the rejections of Claims 67-71 be withdrawn.

Claims 72-77 Are In Condition For Allowance

Claims 72 and 73 were rejected under 35 U.S.C. § 102(b) as being anticipated by Fujii et al. The Examiner asserts that Fujii teaches the apparatus substantially as claimed. Claims 74-77 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Fujii et al. In view of Summerfelt et al (US 5,781,404). Applicant traverses the rejection and respectfully disagrees with the Examiner's characterization of the cited references.

Applicant respectfully submits that the prior art of record does not teach or suggest the unique combination of limitations recited in Claim 72 as amended. For example, Applicant submits that the prior art of record does not teach or suggest the limitation, "wherein the nucleation layer is a metal selected from the group consisting of Ti, Nb and Mn." Thus, for at least the above reasons, Applicant submits that Claim 72 is in condition for allowance.

The Examiner asserted that Summerfelt's TABLE 2 teaches that the layer (32) can be formed of Nb or Mn instead of St. Applicant respectfully disagrees. TABLE 2 of Summerfelt et. al. does not indicate that the "lower dielectric layer 32" can be made of Nb or Mn. Nb and Mn are listed as possible alternative materials for use in the "surrounding dielectric buffer layer 38." In addition to the fact that Summerfelt cannot be properly combined with Fujii as discussed above, Applicant respectfully submits that a "surrounding dielectric buffer layer" as described in Summerfelt does not fairly suggest the features of the thin film structure recited in Applicant's Claim 72. Thus Applicant submits that the combination suggested by the Examiner involves improper hindsight by arbitrarily selecting elements of the prior art in order to make the claimed invention. Applicant therefore submits

Appl. No : 09/971,155
Filed : October 4, 2001

that Claim 72 is in condition for allowance, and respectfully requests that the rejection be withdrawn.

Applicant submits that dependent claims 73-77 include the unique combination of limitations of independent claim 72 from which they depend, as well as additional unique combinations of limitations also not taught or suggested by the prior art of record.

CONCLUSION

In view of the foregoing amendments and remarks, Applicant submits that this application is in condition for allowance and such action is respectfully requested. The undersigned has made a good faith effort to respond to all of the rejections and objections in the case, and to place the claims in condition for allowance. Nevertheless, if any undeveloped issues remain or if any issues require clarification, the Examiner is respectfully requested to call Applicant's representative at the number indicated below in order to resolve such issues promptly.

Respectfully submitted,

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